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Feature Story

Stop the World From Spinning!

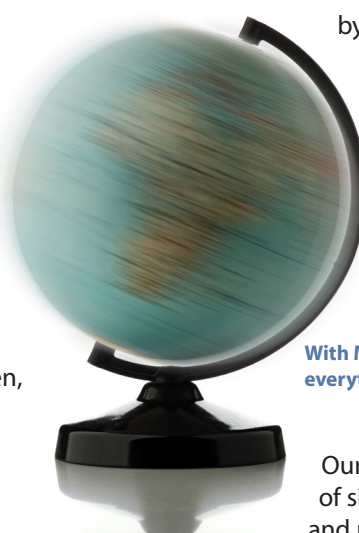
World's First Vestibular Implant Attempts to Treat the Vertigo of Ménière's Disease

By Robin Latham

Imagine walking down the street when you suddenly hear a roaring in one ear and everything around you begins to violently spin. You might drop to your knees, unable to control the overwhelming dizziness and nausea that is likely to keep you confined to a dark, quiet room for several hours or more until it gets better. Even worse, now that it has happened, you will never know when, or if, it will happen again.

This is what life is like for someone with Ménière's disease, a balance disorder that affects approximately 600,000 people a year in the United States, and primarily strikes adults between 40 and 60 years old. Most people only experience problems in one ear, but a small minority will have attacks in both. Researchers still aren't entirely sure what causes the tinnitus and vertigo of Ménière's disease, although they do know that it has to be the result of some kind of disturbance in the vestibular system that helps us maintain our sense of balance. The treatments currently available for Ménière's disease aren't always effective and some can only end the dizziness by causing hearing loss. Some people are never able to find relief from their disabling symptoms and live with the uncertainty and the attacks of dizziness for the rest of their lives.

This could begin to change, thanks to the work of Jay Rubinstein, M.D., Ph.D., James Phillips, Ph.D., and their patient, a 56-year-old man with Ménière's disease who is the world's first recipient of an implanted device designed to stop the severe vertigo associated with the disease. The device is the result of more than four years of NIDCD-supported design and experimentation



by Drs. Phillips and Rubinstein, directors, respectively, of the Clinical Vestibular Laboratory and the Virginia Merrill Bloedel Hearing Research Center at the University of Washington's Department of Otolaryngology–Head and Neck surgery, and their team in Seattle.

With Ménière's disease, you may feel as if everything around you is violently spinning.

Our balance is established by a series of signals that originates in the loops and pouches of three semicircular canals, located in the bony labyrinth of the inner ear. These signals are transmitted to the vestibular nerve that, in turn, sends them as electrical pulses to the brain. The semicircular canals are filled with endolymph, a fluid that is essential to the transmission of the signals. The symptoms of Ménière's disease are thought to stem from the rupture of the semicircular canal membranes and the leaking of endolymph, which breaks down the signaling mechanism with the vestibular nerve.

"The best hypothesis for what occurs during an attack of Ménière's disease is that the ear involved shuts off," says Dr. Rubinstein. "That leaves only one ear to send positional information to the brain." The result is a sensation of severe, swirling vertigo.

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To add your name to our e-mail list, visit
<http://www.nidcd.nih.gov/health/inside/>

If the University of Washington implantable device is successful in the trial patients, doctors will have another option for people with Ménière's disease that resolves their vertigo and spares their hearing.

The University of Washington device attempts to stop a Ménière's attack by restoring a stable pattern of electrical activity in the vestibular nerve of the damaged ear. The device uses the same technology found in a cochlear implant, a medical device that currently provides a sense of sound to more than 188,000 deaf or hard-of-hearing people worldwide.

Like the cochlear implant, the vestibular implant consists of a wireless processor worn behind the affected ear and an implanted device almost directly beneath it. Instead of traveling to the cochlea, however, the electrodes snake into the three semicircular canals—one in each canal. In addition, a handheld controller uses push buttons to start and stop a range of electrical stimuli that can be directed to any or all of the electrodes. The rates and intensities of these signals are customized to each patient.

According to Dr. Rubinstein, at the first warning signs of an attack—usually either an extreme feeling of pressure in the ear or roaring tinnitus—an individual wearing the implant only has to push the buttons until he or she finds a series of signals that may make the symptoms retreat. "They can start by stimulating one of the semicircular canals—the one that we think is the most likely to control their symptoms," says Dr. Rubinstein. "But that could change the symptoms in such a way that we'll need to activate the other canals as well." Once the dizziness is gone, the controller is turned off.

The first of ten patients in the surgical trial—a man whose symptoms have resisted treatment for the past two years—was implanted with a device this past October. Dr. Rubinstein and his team have been calibrating the device and programming the controller with different electrical stimuli rates and intensities that can be sent to any one of the three electrodes in the semicircular canals.

Next, they'll be sending the patient back to his home with the handheld device to see how successful it is in fending off attacks. Depending on the results, the medical team will begin to implant the others in the trial group.

The current standard of treatment for Ménière's disease is to prescribe medications to control the vertigo and nausea, and diuretics to reduce the amount of fluid the body retains, which may help lower fluid volume and pressure in the inner ear. A recently FDA-approved device that fits into the outer ear and delivers intermittent air pressure pulses to the middle ear has also been successful for some people. But there are still many people with Ménière's disease whose only options are invasive and involve surgery.

"There are a variety of surgical procedures to treat Ménière's disease," says Dr. Rubinstein, "because none of them are optimal." All of them involve destroying the ear in some way. This includes the use of an antibiotic, gentamicin, which is injected through the eardrum to reach the inner ear. Although gentamicin helps reduce dizziness by reducing balance sensation, it occasionally also destroys sensory cells in the cochlea and causes permanent hearing loss.

If the University of Washington implantable device is successful in the trial patients, doctors will have another option for people with Ménière's disease that resolves their vertigo and spares their hearing. Moreover, if it is found to help control vertigo—a symptom of a number of balance disorders—it may be useful in the treatment of many more people as well.

Learn more about Dr. Rubinstein's research at <http://depts.washington.edu/coursejo/ESVN/index.html#Mission>, and about Ménière's disease at <http://www.nidcd.nih.gov/health/balance/meniere.html>.

Recent Research and News

Rebooting the Brain Helps Stop the Ring of Tinnitus in Rats

NIH-funded researchers were able to eliminate tinnitus in a group of rats by stimulating a nerve in the neck while simultaneously playing a variety of sound tones over an extended period of time, says a study published in the advance online publication of the journal *Nature*. The hallmark of tinnitus is often a persistent ringing in the ears that is annoying for some, debilitating for others, and currently incurable. Similar to pressing a reset button in the brain, this new therapy was found to help retrain the part of the brain that interprets sound so that errant neurons reverted back to their original state and the ringing disappeared. The research was conducted by scientists from the University of Texas at Dallas and MicroTransponder Inc., in Dallas, and funded in large part by the NIDCD.

Nearly 23 million American adults suffer from tinnitus, and some people experience it as a symptom resulting from hearing loss. Current treatments for this disorder generally involve masking the sound or learning to ignore it. This new study used a technique called vagus nerve stimulation (VNS), which is currently used to treat roughly 50,000 people with epilepsy or depression. MicroTransponder hopes to conduct a pilot clinical study in tinnitus patients using VNS with paired tones in Europe in the near future.

Read more about this research on the NIDCD website at <http://www.nidcd.nih.gov/news/releases/11/011211.htm>, in *Nature* at <http://www.nature.com/nature/journal/vaop/ncurrent/full/nature09656.html>, in *PubMed* at <http://pubmed.gov> and search for PMID: 21228773, or learn more about tinnitus at <http://www.nidcd.nih.gov/health/hearing/tinnitus.htm>.

American Adults Hear Better Than They Did 40 Years Ago

While it's true that genes, loud noise, some medicines, and other factors can cause our hearing to worsen over the years, the good news is that you probably hear better than your grandparents did at your age. That's what

researchers from the NIDCD, the National Institute for Occupational Safety and Health, and the University of Texas Health Science Center at San Antonio have found after comparing the results of two hearing surveys conducted roughly 40 years apart. The findings are published in the December 2010 issue of *Ear and Hearing*.

The researchers compared hearing data gathered from the National Health Examination Survey I (NHES I) in 1959-1962 with those from the National Health and Nutrition Examination Survey (NHANES) in 1999-2004. Although the testing equipment and methods have changed somewhat over the years, the goal was essentially the same: to find the softest sound levels at which randomly selected subjects between the ages of 25 and 64 could hear a range of frequencies, from 500 to 6000 hertz (Hz) for the earlier survey and from 500 to 8000 Hz for the later one.



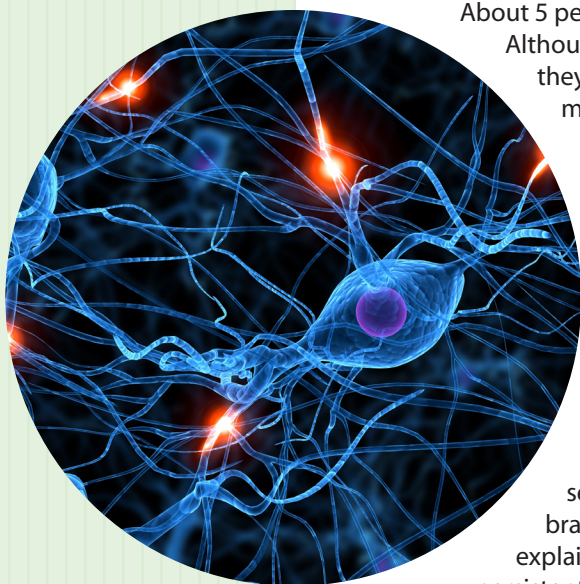
You probably hear better than your grandparents did at your age.

The scientists discovered that men and women today across the age spectrum have better hearing than their decades-older counterparts primarily in the upper frequencies (2,000, 3,000, 4,000, and 6,000 Hz), while being roughly the same for the middle frequency of 1000 Hz. Hearing loss in the upper frequencies makes it especially difficult to discern speech sounds when there's lots of background noise.

Read more on the NIDCD website at <http://www.nidcd.nih.gov/news/releases/10/121710.htm>, or in *Ear and Hearing* at http://journals.lww.com/ear-hearing/Abstract/2010/12000/Americans_Hear_as_Well_or_Better_Today_Compared.1.aspx.

Nearly 23 million American adults suffer from tinnitus, and some people experience it as a symptom resulting from hearing loss.

Results of Brain Imaging May Help Explain Why More Men Than Women Stutter



The women who stuttered had distinctly greater connectivity between the motor and sensory regions in both hemispheres of the brain than the men who stuttered.

About 5 percent of children stutter. Although many leave it behind as they grow older, in adulthood, men are five times more likely than women to still stutter—for reasons that are not well understood. Intramural researchers at the NIDCD and the National Institute of Neurological Disorders and Stroke, led by Soo-Eun Chang, Ph.D., have recently used two brain imaging tools to explore sex-specific differences in brain connections that might explain the striking gender gap in persistent stuttering.

The investigators created brain maps of 18 stuttering and 14 non-stuttering volunteers using functional magnetic resonance imaging (fMRI), which shows brain areas active during speech, and diffusion tensor imaging (DTI), which provides structural information on connections between brain regions. The maps showed that, in general, people who stutter have fewer connections between the motor planning and execution areas in the left hemisphere of their brains and more connections between the right and left hemispheres in comparison with people who don't stutter. The women who stuttered had distinctly greater connectivity between the motor and sensory regions in both hemispheres than the men who stuttered.

Dr. Chang is hoping to replicate the study in children to examine whether these brain differences are present early in life or appear later only in women who continue to stutter as adults. The preliminary findings from this research were presented at the Society for Neuroscience's annual meeting last November. Read the abstract at <http://cms.sfn.org/am2010/press/OmniPress/data/press/010.pdf>.

Finding the Words: New Brain Stimulation Technique Shows Promise for People with Aphasia

Two recent NIDCD-funded research studies from the University of South Carolina have demonstrated how important the location of the brain damage is in predicting how well a person will respond to aphasia therapy after a stroke. They also investigated a new method for stimulating brain-damaged regions in people with aphasia, in hopes of increasing brain plasticity and perhaps improving word recall.

In research published in the *Journal of Neuroscience*, Julius Fridriksson, Ph.D., studied the effect of a standard therapy for improving naming recall on patients who experienced chronic aphasia after suffering a stroke that damaged the brain's left hemisphere, where the language centers are found. He wanted to find out if the therapy helped increase activity in key regions of the brain. He found that some participants showed great improvement in their ability to name objects while others showed little change, depending on the location of the lesion. Participants whose lesions were located in areas specializing in word retrieval and phonological processing, toward the back of the left hemisphere, experienced significantly poorer results than participants whose lesions were located elsewhere. He also found that improvement in naming ability was



With aphasia, words that once came naturally are suddenly difficult to retrieve.

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closely tied to brain activation in regions toward the front as well as farther back in the brain's left hemisphere. "What this study clearly shows is for those patients who do well in treatment, the damaged hemisphere changes and supports that recovery," he said.

Julie Baker, Ph.D., who was working on her dissertation under Dr. Fridriksson, published her research in the June 2010 issue of *Stroke*. She used transcranial direct-current stimulation (tDCS)—a low-current stimulation technique that is safe, non-invasive, and barely detectable to the wearer—to attempt to further stimulate areas of the brain that are already activated during word

retrieval. Dr. Baker found that, for all of the patients enrolled in the study, the numbers of correctly identified names following tDCS stimulation were higher than those following the placebo, not only for words they had worked on during the treatment, but for other words as well.

Read more on this story on the NIDCD website at <http://www.nidcd.nih.gov/news/releases/10/100610.htm>, read Dr. Fridriksson's and Dr. Baker's abstracts in *PubMed* at <http://www.pubmed.gov> and search for PMID: 21228773 and 21233468 respectively, or learn about aphasia at <http://www.nidcd.nih.gov/health/voice/aphasia.html>.

NIDCD Highlights

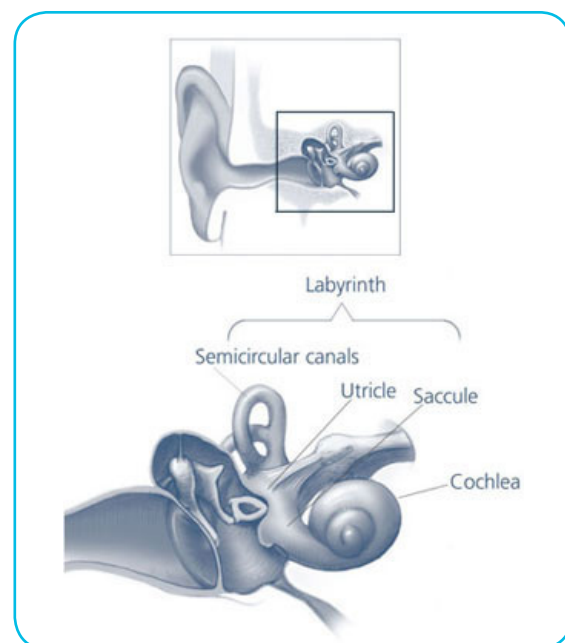
NIH Health Forum Explains Commonly Misunderstood Diseases

Have you ever experienced dizziness accompanied by ringing in the ears and wondered what was happening and why? Or have you experienced the pain and itching of shingles and wondered where it came from? Such commonly experienced, though not commonly understood, conditions were recently discussed at a Science for the Public program, titled *From Amblyopia to Zits: A Health Fair Forum*. The forum was sponsored by NIH's Staff Training in Extramural Programs effort, or STEP, and held on the NIH campus in Bethesda, Md.

The NIDCD's program officer for extramural clinical trials, Gordon Hughes, M.D., delivered a presentation on Ménière's disease, a disorder of the inner ear that causes severe dizziness (vertigo), ringing in the ears (tinnitus), hearing loss, and a feeling of fullness or congestion in the ear. Dr. Hughes outlined the diagnosis, treatment, and prognosis of Ménière's disease, based on his vast clinical experience treating patients at the Cleveland Clinic Head and Neck Institute, where he was for many years before coming to the NIDCD. He introduced readily available therapies that physicians use to control the disease symptoms: from the standard of care, which includes a low-salt diet, diuretics (water pills), and observation; to a device that patients can use to deliver pulses of air to the middle ear at the onset of an episode; to,

in more severe cases, methods such as middle and inner ear surgeries. He also presented the pros and cons of each available treatment and talked about the profile of the best candidate for each therapy.

Read about Ménière's disease at <http://www.nidcd.nih.gov/health/balance/meniere.html>.



Ménière's disease, a disorder of the inner ear, was one of the topics discussed at the NIH forum.

Credit: NIH Medical Arts

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Healthy People 2020 Plans for a Healthier Nation

For the last three decades, Healthy People has set the country's health promotion and disease prevention agenda by establishing overarching goals and tracking the nation's progress toward those goals. Last December, the U.S. Department of Health and Human Services launched Healthy People 2020, which for the first time includes a separate section on the NIDCD's mission areas, titled *Hearing and Other Sensory or Communication Disorders*.

The new section includes goals and objectives on newborn hearing screening; ear infections; hearing; tinnitus; and balance and dizziness as well as new developmental goals for the areas



of smell and taste; voice, speech, and language; and Internet health care resources for health professionals. The Healthy People 2020 campaign aims to unify the national dialogue about health and encourage new directions in health promotion by providing a public health roadmap for the country.

Learn about the new goals for Hearing and Other Sensory or Communication Disorders at <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=20>.

Grants News

NIDCD Grantee Wins Presidential Early Career Award

NIDCD grantee Alfredo Fontanini, M.D., Ph.D., assistant professor of neurobiology and behavior at Stony Brook University, Stony Brook, N.Y., received a Presidential Early Career Award for Scientists and Engineers (PECASE), as announced by President Obama last November.

Dr. Fontanini's research focuses on how the processing and perception of taste is affected by prior experiences and emotions. He studies neuron activity in sensory and emotional areas of the rodent brain, trying to understand how much of taste sensation is predetermined by expectation and what part is due to the actual stimulus. His research may help us better understand the neural basis behind food preferences and selection choices, in addition to understanding the role expectation plays in addictions and mood disorders.

The PECASE Award is the highest honor by the U.S. government to young scientists and engineers. Read more on the NIDCD website at <http://www.nidcd.nih.gov/news/releases/10/121310.htm>.



Dr. Fontanini is a recipient of the PECASE Award, the highest honor by the U.S. government to young scientists and engineers.

Credit: Photo courtesy of Dr. Fontanini.

Meetings of Interest

National Hispanic Medical Association, NHMA

March 17-20, Washington, DC

Web info: <http://www.nhmamd.org>



The 15th Annual Conference, *Health Care Reform Implementation for Hispanic Communities*, brings together physicians, residents, medical students, nurses, dentists, policymakers, and health care industry representatives, along with partners from the federal and state governments and the private sector, to share their multidisciplinary experiences in improving health care delivery for Hispanic populations. CME accreditation will be provided.

American Academy of Audiology, AAA

April 6-9, Chicago, IL

Web info: <http://www.audiologynow.org>



AudiologyNOW! 2011, the annual convention of AAA, is the place for practitioners, researchers, and exhibitors to share the latest in clinical concepts, technology, and practice development. Many sessions will be grouped within areas of concentration called SuperTracks, including: neuro-audiology, pediatrics, practice-related issues, treatment, and other hot topics. Look for a presentation by NIDCD Research Training Officer Daniel A. Sklare, Ph.D. *Launching Your Research Career Trajectory through the NIDCD* is on Friday, April 8. It seeks to demystify the process of obtaining research and research training grants from the NIH.

National Association of Elementary School Principals, NAESP

April 7-10, Tampa, FL

Web info: <http://www.naesp.org>



At the NAESP 2011 Annual Convention and Exposition general session speakers will address creativity and positive thinking, while at the five plenary sessions experts will focus on evaluation of classroom instruction, school culture, leading for change, and technology supporting accountability and communication.

Association for Chemoreception Sciences, AChemS

April 13-17, St. Pete Beach, FL

Web info: <http://www.achems.org/i4a/pages/index.cfm?pageid=3279>



The AChemS XXXIII Annual Meeting brings together researchers from the United States and the world to present and discuss the latest research in the broad field of the chemical senses, including the senses of taste and smell, chemical irritation, and gastrointestinal chemosensation. The meeting is designed to provide an integrative approach as well as a historical context for modern research in the field. The meeting includes symposia, workshops, and thematic collections of volunteer papers, as well as extensive poster sessions.

Beyond the NIDCD: News from Other Organizations

The Stuttering Foundation and Boston University co-sponsor *The Eastern Workshop: Cognitive Approaches to Working with People Who Stutter* on June 13-24. This two-week program will include training in cognitive behavioral therapy, solution-focused brief therapy, Palin parent-child interaction therapy, and family communication skills. Full fellowships are available from the Stuttering Foundation. For more information, call (800) 992-9392 or visit <http://www.StutteringHelp.org>. The deadline to register is March 15.

The National Association of the Deaf (NAD) announces the 2011 NAD Youth Leadership Camp from June 22 through July 20 at Camp Taloali, which features 111 acres of forested land in the foothills of Oregon's Cascade Mountains. Camper and staff application forms are now online at <http://www.nad.org/2011ylc>. The camper application deadline is March 31, 2011, and the staff application deadline is April 6, 2011.

Hands and Voices is devoted to improving support for families with children who are deaf or hard-of-hearing and the professionals who serve them. Hands & Voices is working closely

with special education researcher Harold Johnson at Michigan State University on a pilot project, in Colorado, called *Observe, Understand, and Respond: The O.U.R. Children's Safety Project*. The project addresses the higher risk that children who are deaf or hard-of-hearing have for abuse and neglect. To learn more about this project, visit the Hands and Voices website at <http://www.handsandvoices.org/resources/OUR/index.htm>, or join in their wiki, at <http://deafed-childabuse-neglect-col.wiki.educ.msu.edu>.

Easter Seals Project ACTION (Accessible Community Transportation in Our Nation) offers training, technical assistance, and transportation service to people with disabilities, and has worked to promote universal access to transportation under federal law and beyond. ESPA hosts teleconferences and webinars on accessible transportation topics, online courses, and community-based coalition-building events. Real-time transcription is offered for all distance learning events, and interpreters are available for in-person training. For more information, visit <http://www.projectaction.org>, e-mail projectaction@easterseals.com, call (800) 659-6428 or TDD (202) 347-7385.

New Resources

Updated Fact Sheets on Swallowing and Voice Disorders Now Available

Updated fact sheets on dysphagia, a swallowing disorder, and spasmodic dysphonia and recurrent respiratory papillomatosis, two voice disorders, are now available in print and online on the NIDCD website.

Dysphagia can result from cerebral palsy, Parkinson's disease, stroke, head injury, and other conditions that weaken or damage the muscles and nerves used for swallowing. It happens most frequently in older adults. Read more at <http://www.nidcd.nih.gov/health/voice/dysph.html>.



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Spasmodic dysphonia is a neurological disorder affecting the voice muscles in the larynx, or voice box. The muscles inside the vocal folds experience sudden involuntary movements—called spasms—which interfere with the ability of the folds to vibrate and produce voice. Read more at <http://www.nidcd.nih.gov/health/voice/spasdysp.html>.

Recurrent respiratory papillomatosis (RRP) is a disease in which tumors grow in the air passages leading from the nose and mouth into the lungs. Their presence in the larynx can interfere with the normal vibrations of the vocal folds, causing hoarseness, which is the most common symptom. Read more at <http://www.nidcd.nih.gov/health/voice/laryngeal.html>.

NIDCD and NCI Collaborate to Update Booklet on Cancer of the Larynx

The NIDCD and the National Cancer Institute (NCI) recently updated *What You Need to Know About Cancer of the Larynx*. This patient education booklet describes how a laryngeal cancer patient can work with a team of specialists to devise a plan of medical care tailored to his or her needs. Also, it helps prepare patients for the effects of laryngeal cancer and its treatment, and provides tips for managing problems they may have with speaking and swallowing. Find the electronic versions on the NCI website at <http://www.cancer.gov/cancertopics/wyntk/larynx> or request a print copy by calling 1-800-4-CANCER (1-800-422-6237).